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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/581,430

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Masuaki Okada

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EXAMINER

DANG, TRUNG Q

ART UNIT

PAPER NUMBER

2892

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03/10/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/581,430	Applicant(s) OKADA, MASUAKI	
	Examiner Trung Dang	Art Unit 2892	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 June 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
- 4a) Of the above claim(s) 19-35 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 and 36-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The indicated allowability of claims 5 and 13-16 is withdrawn in view of the newly discovered reference(s) to Nagakubo et al. (US 5,421,953). Rejections based on the newly cited reference(s) follow.

Please insert F.P. 4.06, 4.07 or 4.08 here, need to determine appropriate one. Also, please indicate that the OA to be sent to

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Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, 6, and 17-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Katada et al. (US 5,383,993 of record).

The rejection is maintained as of record and repeated herein.

With reference to Figs. 2(a)-2(c) and TABLE 1, the prior art teaches the claimed invention in that it discloses a bonding method comprises:

subjecting bonding surfaces of a first and second semiconductor substrate to an activation treatment using oxygen plasma thereby rendering said surfaces hydrophilic (col. 2, lines 40-46; col. 4, lines 3-34, and TABLE 1);

thereafter performing anodic bonding said first and second semiconductor substrate (Fig. 2(c) and col. 6, lines 17-35 that are considered with the disclosure in TABLE 1 in which the surfaces of the first and second substrate are treated with oxygen plasma).

Note that, plasma is a partially ionized gas that contains charged particles (ions and electrons) and neutral active atoms (see para. [0044] of US 2009/0026587 which is cited herein merely for the purpose of showing this fact). The prior art plasma is, therefore, read on the claimed atom beam or ion beam because the plasma includes atoms and ions.

For claim 2, see Fig. 1(c), Fig. 2(c) and related text.

For claim 6, see col. 4, lines 45-46 for the preliminary bonding taking place in a clean room (i.e., room temperature), and Fig. 2(c) for the main anodic bonding that is performed in a separate step or device.

For claim 17, see TABLE 1.

For claim 18, the pressure sensor of Fig. 3(a) is a MEMS device.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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5. Claims 1-6, 10-17, 36, 37, 40-42, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagakubo et al. (US 5,421,953) in view of Henley et al. (US 6,291, 314)

With reference to Figs. 2A-2D and Fig. 3, Nagakubo teaches a direct bonding process in a vacuum at room temperature, comprising:

a) subjecting bonding surfaces of both objects 13 and 14 to be bonded to a cleaning step using an Ar ion beam 22 to remove impurity atoms from the surfaces, the surfaces of the bodies are **activated** by creating dangling bonds there (Figs. 2A, 3, and col. 2, lines 19-22, lines 55-60);

b) subjecting said clean surfaces to a surface activation treatment using a plasma beam 36 containing oxygen ions and hydrogen ions to absorb hydroxide group to the surfaces of objects 13 and 14 (Figs. 3, 2C, and col.7, lines 5-23. Note that plasma contains both atoms and ions as noted above); and

c) direct bonding said treated surfaces of objects 13 and 14 in vacuum (Fig. 7 and col. 8, lines 33-57; also see Forth Embodiment in which the bonding is performed by two separate steps: a preliminary bonding and a main bonding to remove water molecule from the bonding interface).

Nagakubo differs from the claims in that while Nagakubo performs a direct bonding of objects 13 and 14, the claims call for an anodic bonding of the same.

Henley teaches various techniques for bonding two objects together at low temperature. Such techniques includes a self-bonding process (i.e., direct bonding) which requires a selected amount of pressure placed on each exposed surface of the

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objects to self-bond one object to the other (line 62 of col. 13 to line 4 of col. 14), a bonding using an adhesive layer (col. 14, lines 5-14), and an electro-static bonding (col. 14, lines 15-19; also known as anodic bonding). Henley further teaches the benefit of anodic bonding process (e.g. the bonding process that requires application of voltage between the two objects). That is, the voltage applied between the two objects raises temperature of the objects to induce the bonding. This technique limits the amount of crystal defects introduced into the silicon wafers during bonding process since substantially no mechanical forces is needed to initiate the bonding action (col. 15, lines 59-65).

It would have been obvious to one of ordinary skill in the art to modify Nagakubo's teaching by performing the bonding step c) using anodic bonding rather than self-bonding process because of the aforementioned advantage for achieving predictable result of bonding objects 13 and 14 without crystal defects.

For claim 2, since the disclosed bonding process is performed at room temperature, hence the claimed limitation "both the objects to be bonded are heated at less than 400 °C during bonding" is met.

For claim 3, the disclosed bonding process is performed in vacuum, i.e, without exposing to the atmospheric air.

For claim 4, step a) reads on the claimed surface activation treatment, hence step b) reads on the claimed limitation regarding subjecting the bonding surfaces to a low-pressure plasma because the disclosed processing steps are carried out in vacuum.

For claim 5, see col. 6, lines 10-11.

For claim 6, see the Forth Embodiment in which the bonding is performed by two separate steps: a preliminary bonding step (i.e., prior to removing water molecules from the bonding interface) and a main bonding step.

For claim 10, step b) reads on the claimed surface activation treatment using plasma.

For claims 11 and 12, see the Forth Embodiment and the interpretation with respect to claim 4.

For claim 13, see Forth Embodiment, the preliminary bonding is performed after step b) above.

For claims 14-16, step a) reads on the claimed physical treatment using Ar and step b) reads on the claimed chemical treatment using oxygen.

For claims 36, 37, 40-42 since the bonding is performed at room temperature, the claimed limitation "both the objects to be bonded are heated at less than 400 °C during bonding" is met.

For claim 47, step b) reads on the claimed hydrophilic treatment using plasma.

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6. Claims 1, 2, 6-8, 10, 12, 17, 18, 38, 39, 45, 46, 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang (US 2005/0101059 of record).

Yang teaches a bonding process comprising:

i) subjecting bonding surfaces of both the objects to be bonded to a surface activation treatment using an energy wave, such as a argon plasma to render the surface of the bonding surfaces hydrophilic;

ii) after the plasma treatment, bringing both objects into contact at room temperature to effectuate the bonding process (see para. [0039]).

Note that the prior art plasma also reads on the claimed atom beam and ion beam for the same reason noted above.

Yang also suggests that the bonding process can be selected from **at least** a plasma activated bonding, eutectic bonding, adhesive bonding, welding, and an anodic bonding (see claim 9).

It would have been obvious to one of ordinary skill in the art to perform the bonding process of step ii) by a combination of the plasma activated bonding and the anodic bonding as suggested by Yang because using a combination of techniques known in the art, each of which performs the same function, to achieve predictable results would have been within the level one skilled in the art. Note that the plasma activated bonding at room temperature reads on the claimed preliminary bonding and the anodic bonding step reads on the claimed main bonding.

For claim 2, the preliminary bonding is performed at room temperature, hence the claimed limitation “both the objects to be bonded are heated at less than 400 °C during bonding” is met.

For claim 6, the anodic bonding step is a separate step from the plasma activated bonding.

For claim 7, Fig. 3c shows a single transparent member 354 is aligned and bonded to a substrate containing a plurality of MEMS devices, hence a single placement of the transparent member 354 on the substrate (i.e., a single preliminary bonding) results in a plurality of anodic bonding steps corresponding to each MEMS device.

For claim 8, para. [0032] discloses that AR coating may be applied to the top surface of the transparent member. Thus, when the transparent member is bonded to the substrate, the AR coating layer is interposed between the substrate and the transparent member. Since the material of the AR coating is different from the materials of the substrate and the transparent member, the coefficient of linear expansion of the AR coating is different from that of the substrate and the transparent member.

For claim 18, see para. [0022] for the semiconductor device is a MEMS device.

For claims 38 and 39, the preliminary bonding step is performed at room temperature, hence the claimed limitation "both the objects to be bonded are heated at less than 400 °C during bonding" is met.

For claims 48-49, the prior art argon plasma treatment reads on the claimed "hydrophilic treatment".

7. Claims 9, 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang as above in view of Katada et al. cited above

Yang teaches an anodic bonding process as described above. Although Yang discloses the plasma activated bonding (preliminary bonding) is performed in a low-pressure chamber under a low pressure (i.e., 35 mTorr in para. [0039]), Yang is silent as to the anodic bonding is performed in the atmosphere air using separate device.

In the same field of endeavor, Katada teaches a bonding process in which anodic bonding is performed in the atmospheric air using separate device including power source 42 (Fig. 2c).

It would have been obvious to one of ordinary skill in the art to modify Yang's teaching by performing the anodic bonding in the atmospheric air using a separate device as suggested by Katada because such bonding ambient carried out by anodic bonding is known, and the application of a know technique to make the same would have been within the level of one skilled in the art.

Response to Arguments

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8. Applicant's arguments with respect to claims 1, 3, 5, 7, 8, 11, 13, 14 have been considered but are moot in view of the new ground(s) of rejection.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857. The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao Le can be reached on 571-272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

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/Trung Dang/
Primary Examiner, Art Unit 2892

2/19/09

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